Soil Quality Improvements with Biochar and Compost

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BLACK CARBON (BC)

Black Carbon is a spectrum.

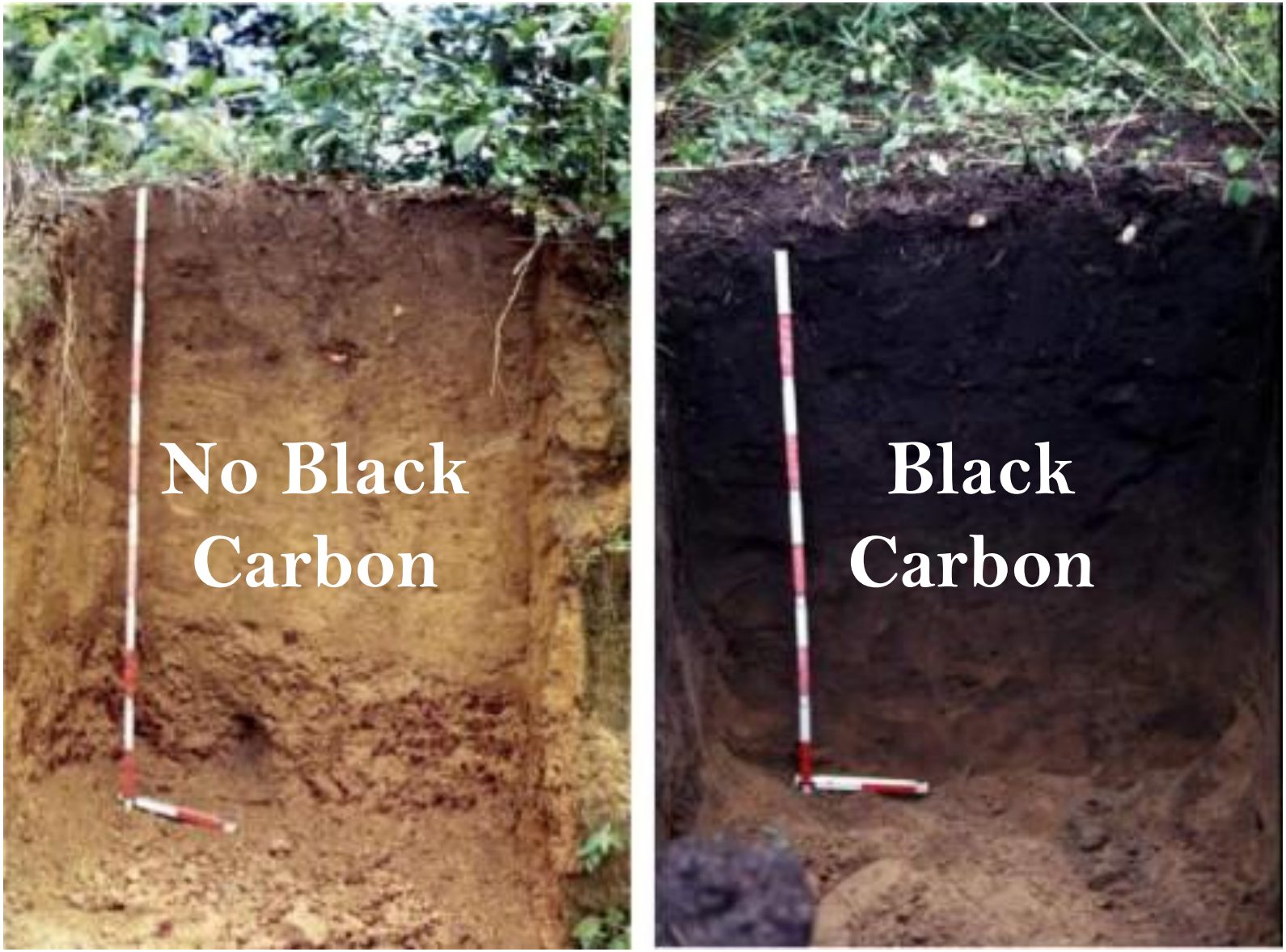


Photo Courtesy: Bruno Glaser, Jago Jonathan Birk, State of the scientific knowledge on properties and genesis of Anthropogenic Dark Earths in Central Amazonia (terra preta de Índio), Geochimica et Cosmochimica Acta, Volume 82, 2012, Pages 39-51.


Biochar

Academic (fancy) definition:

Pyrogenic Carbonaceous Materials

Biochar is (simply):

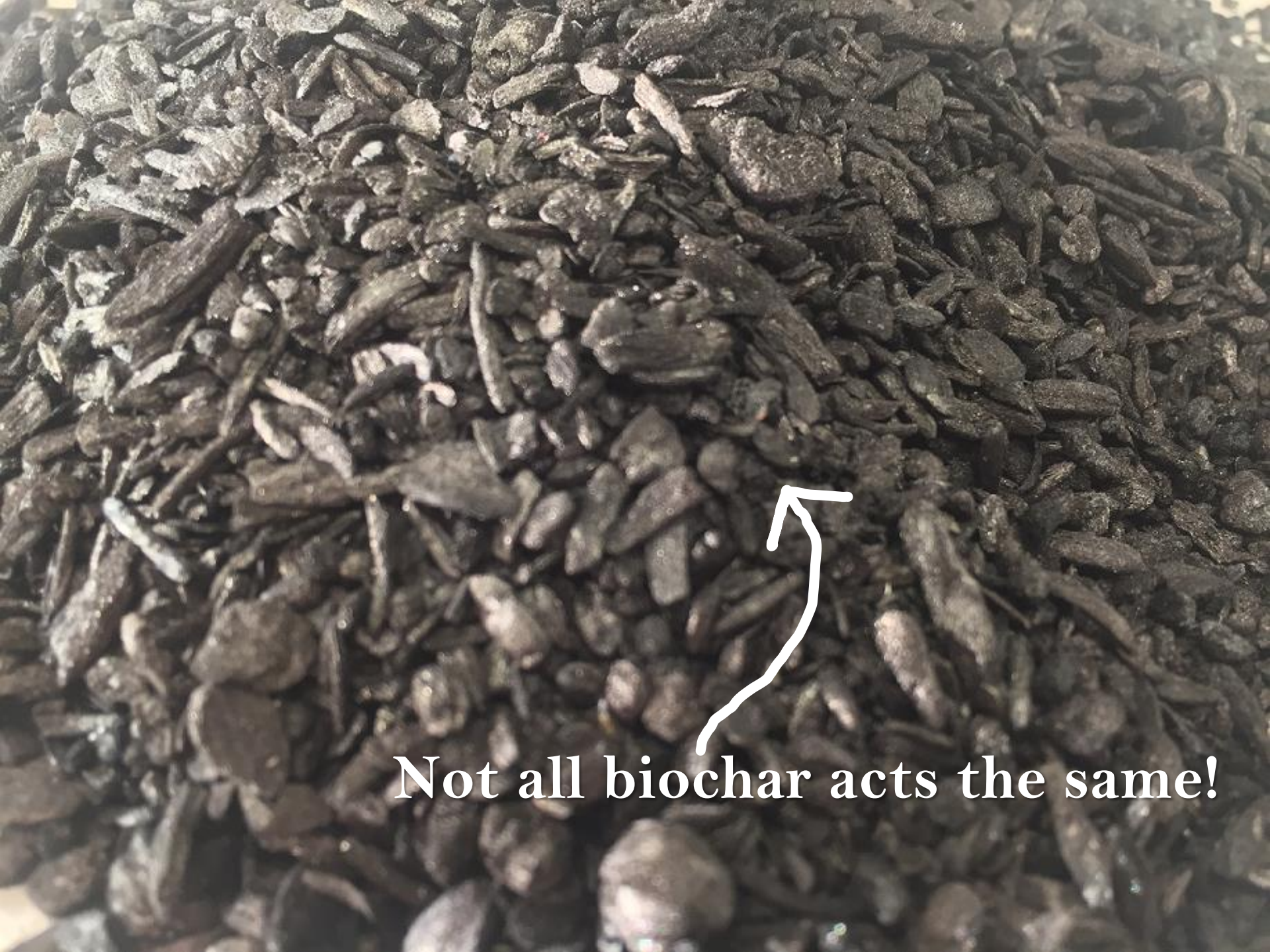
Carbon (C) rich material

Made from biomass

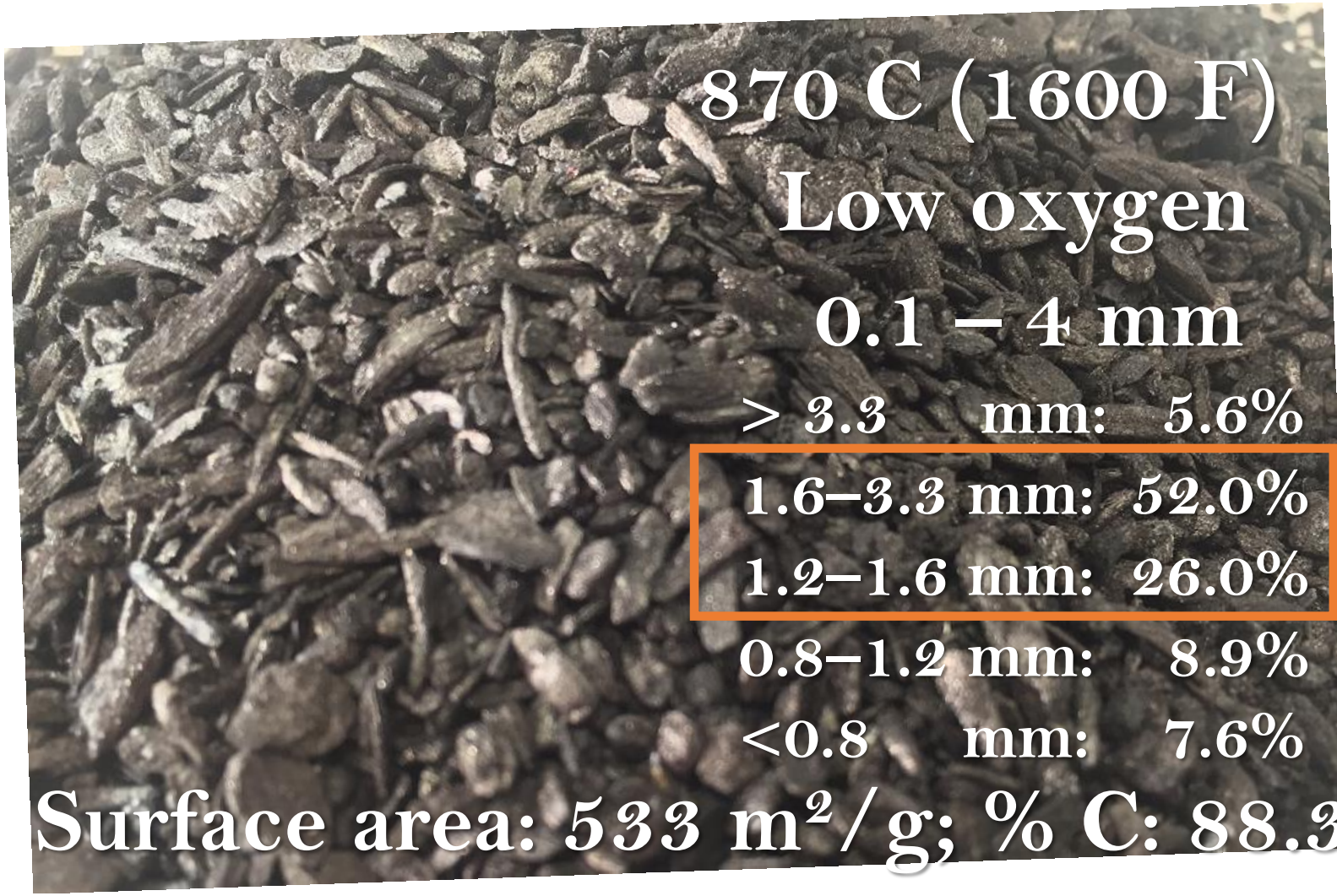
Using high temps.

In a low oxygen environment

(Pyrolysis)


Not all biochar acts the same!

Oregon Biochar Solutions Rogue Biochar



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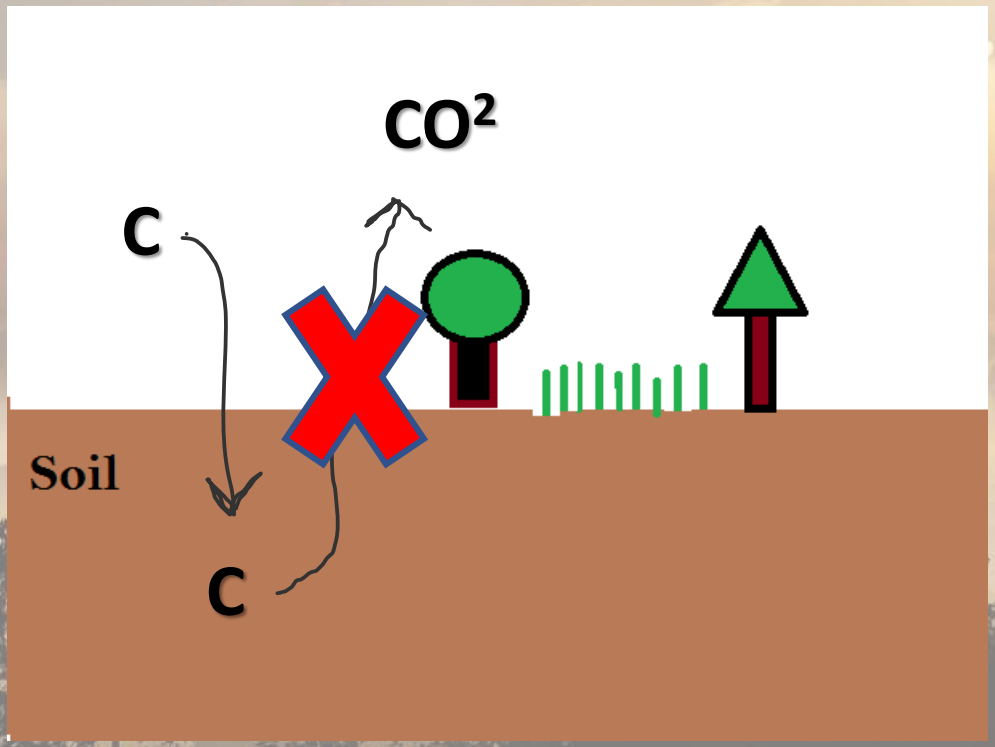
Biochar does what to the soil?

Carbon Storage

Soil conditioner



Biochar does what to the soil?

Soil conditioner

Biochar can affect soil physical properties.

Increases aggregate stability

Improves water holding capacity

Can reduce bulk density

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Biochar can affect soil chemical properties.

Reduces bio-availability of Pb, Cd, and As

Influences cycling of plant nutrients (details not quite clear)

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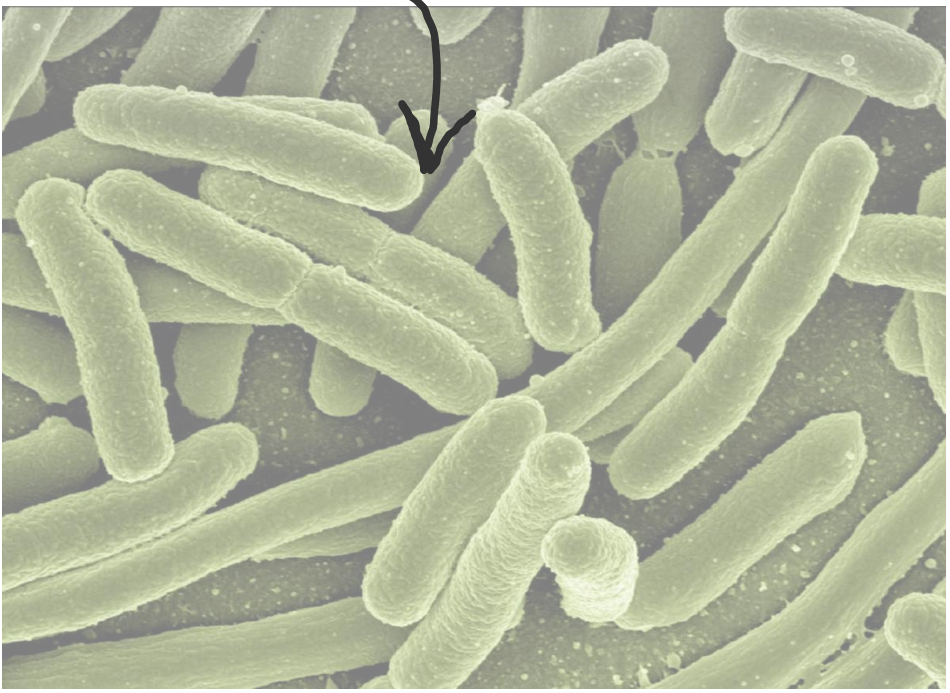
Biochar can affect soil biological properties.

Bacteria



Fungi

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Biochar experiment.

Biochar experiment treatments.

Biochar

Compost

Compost mixed with biochar (as it composted)

Compost mixed with biochar (at the time of application)

Control

Amendment properties

Treatment	C %*	N %*	NO_3/ NH_4 ppm*	Ash %*	pH	BD lbs yd^{-1}	% Moist
Biochar	88.3	0.78	na	3.7	8.0	460	3.1
Compost	32	2.2	31/ 270	38.1	8.5	891	52.1
Co-compost	32	2.2	130/ 95	38.9	8.3	891	52.7

*Dry weight basis

Treatment rates.

Treatment	Rate (yds/acre)	Rate (dry tons/acre)
Biochar	21.30	4.5
Compost	29.05	12.2
Co-composted biochar	29.05	12.2
Compost + biochar	(14.35) + (10.19)	(6.025) + (1.4)
Control	0	0

Amendments applied at 3.9 tons organic C / acre

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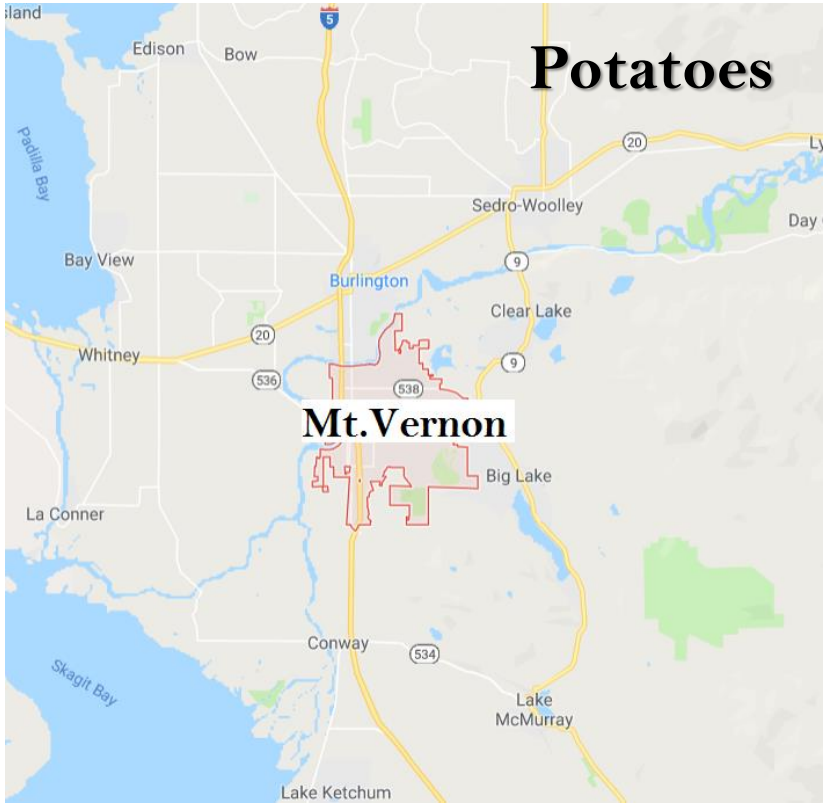
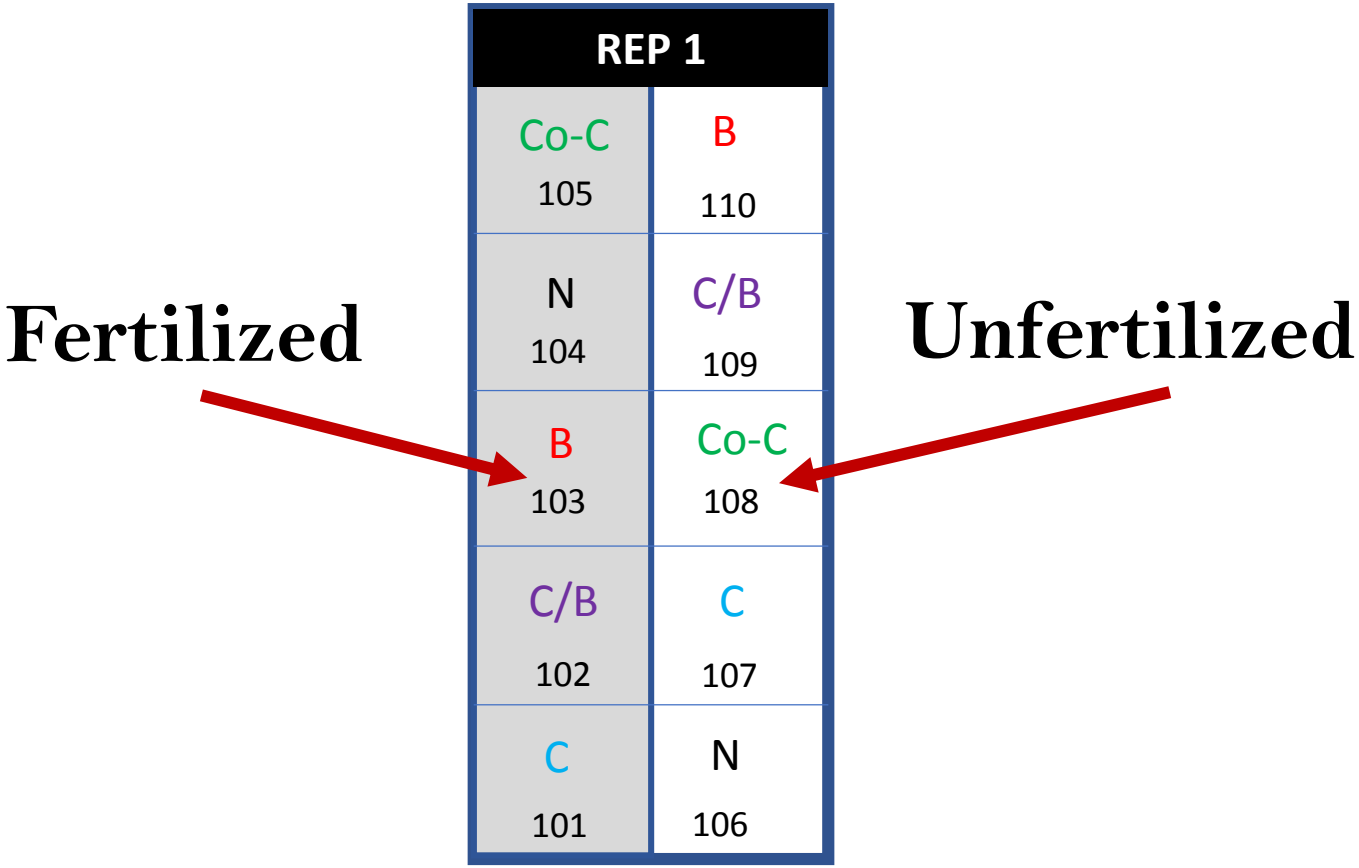
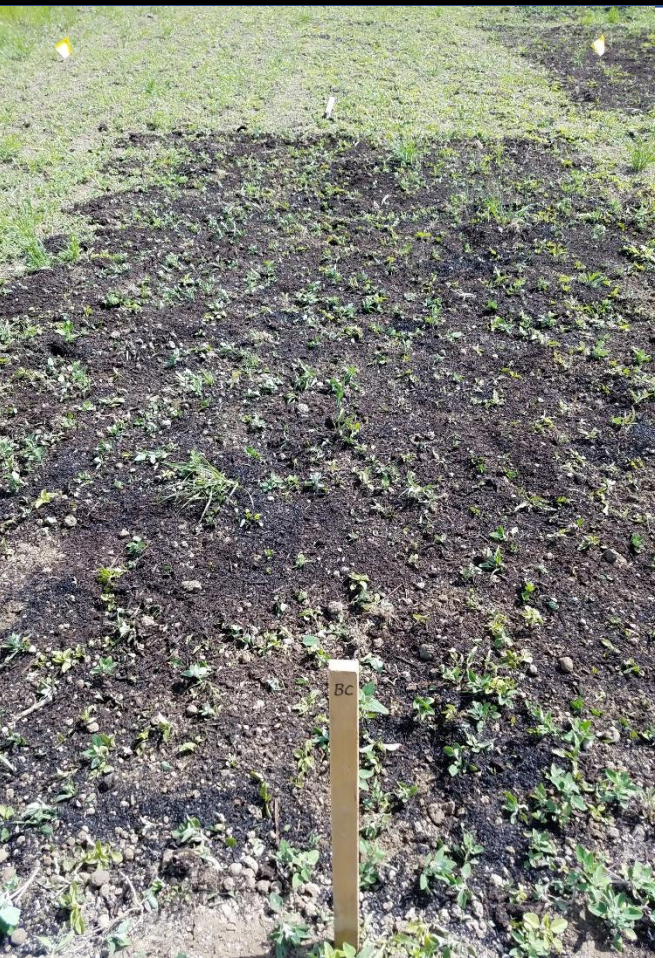
Biochar experiment.



Biochar experiment treatments.



Biochar experiment response variables.



Data:

Yield

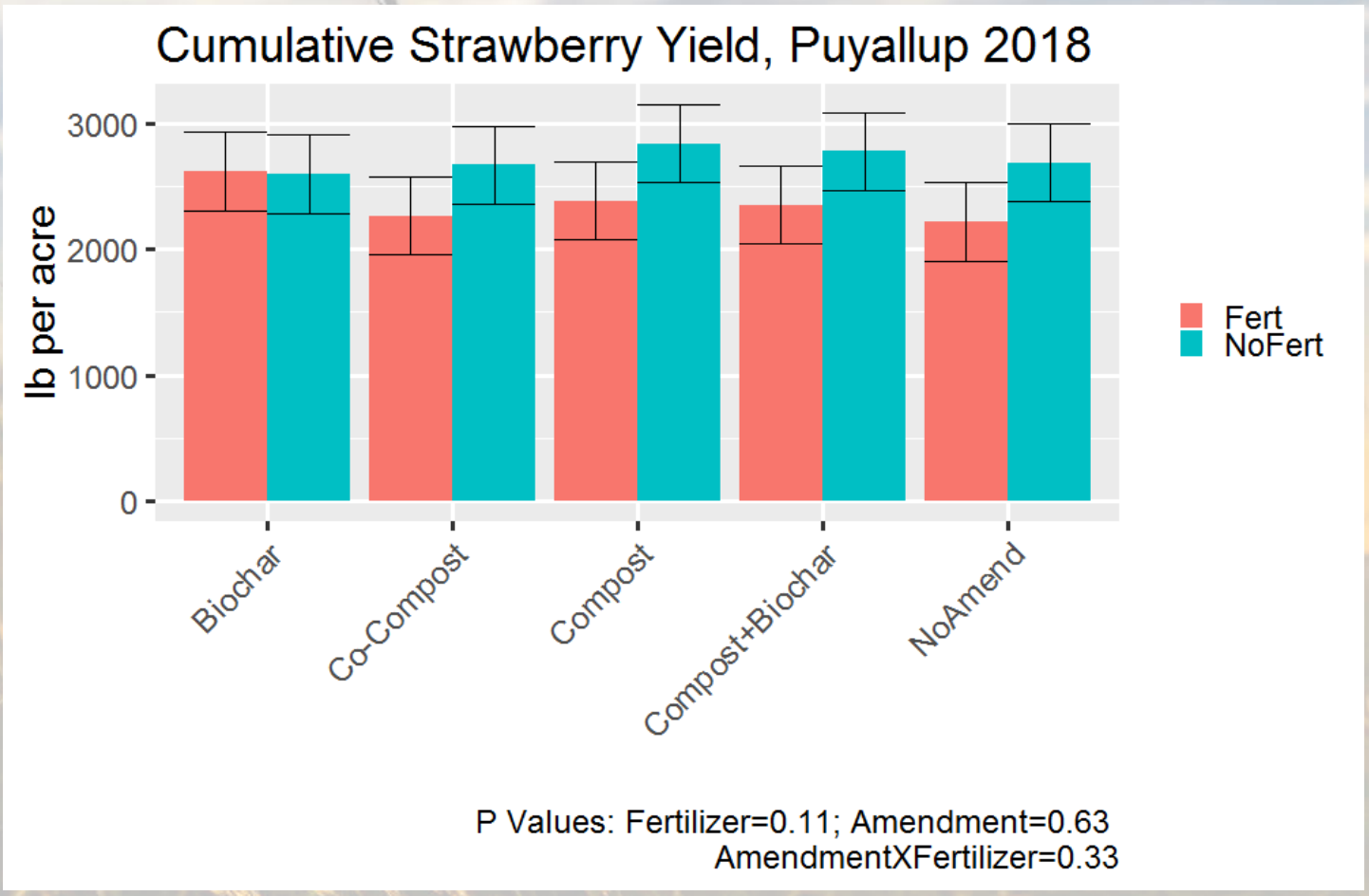
Bulk density

Water holding capacity

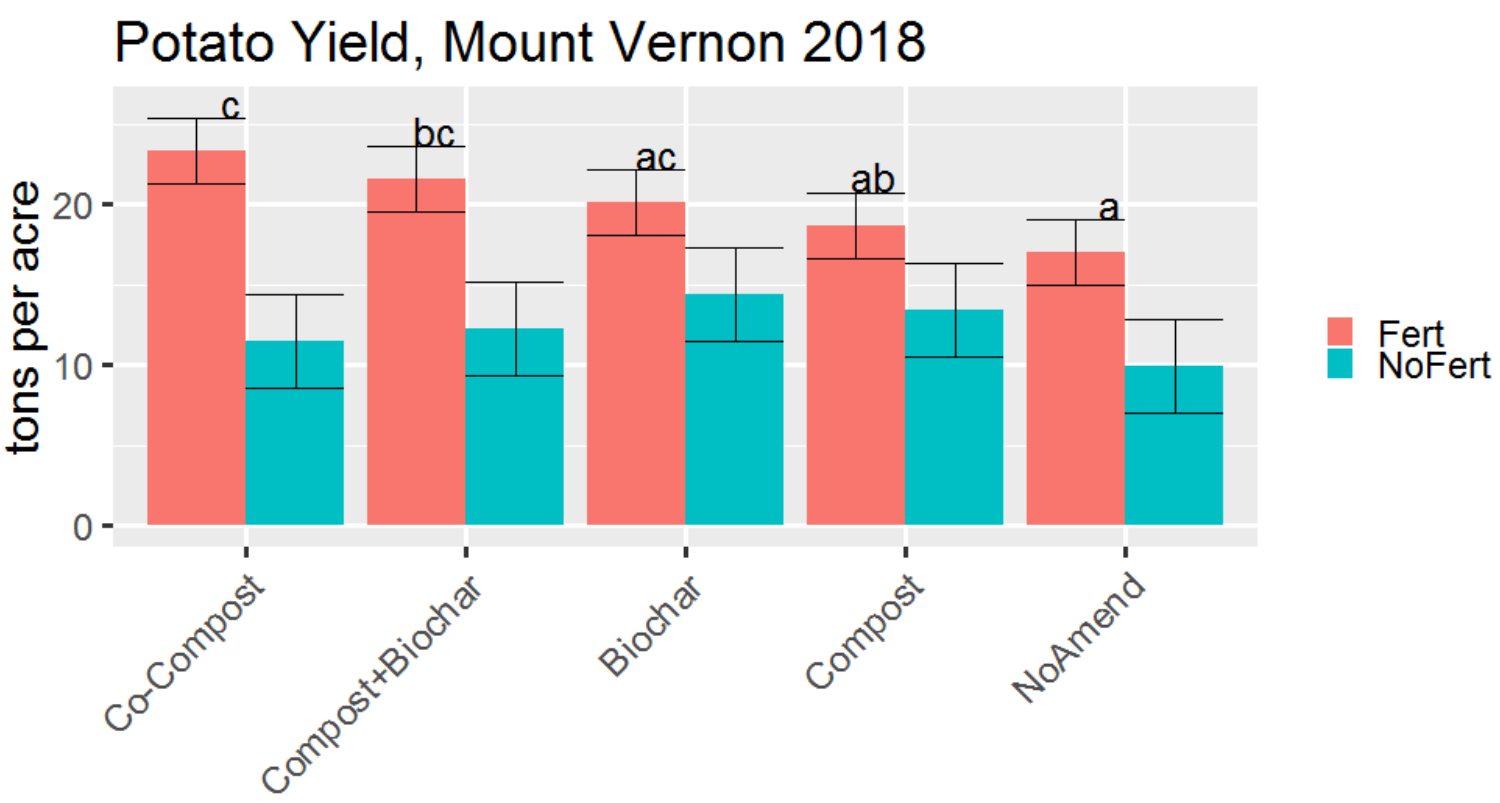
Nutrient availability

POMC

Biochar initial results.

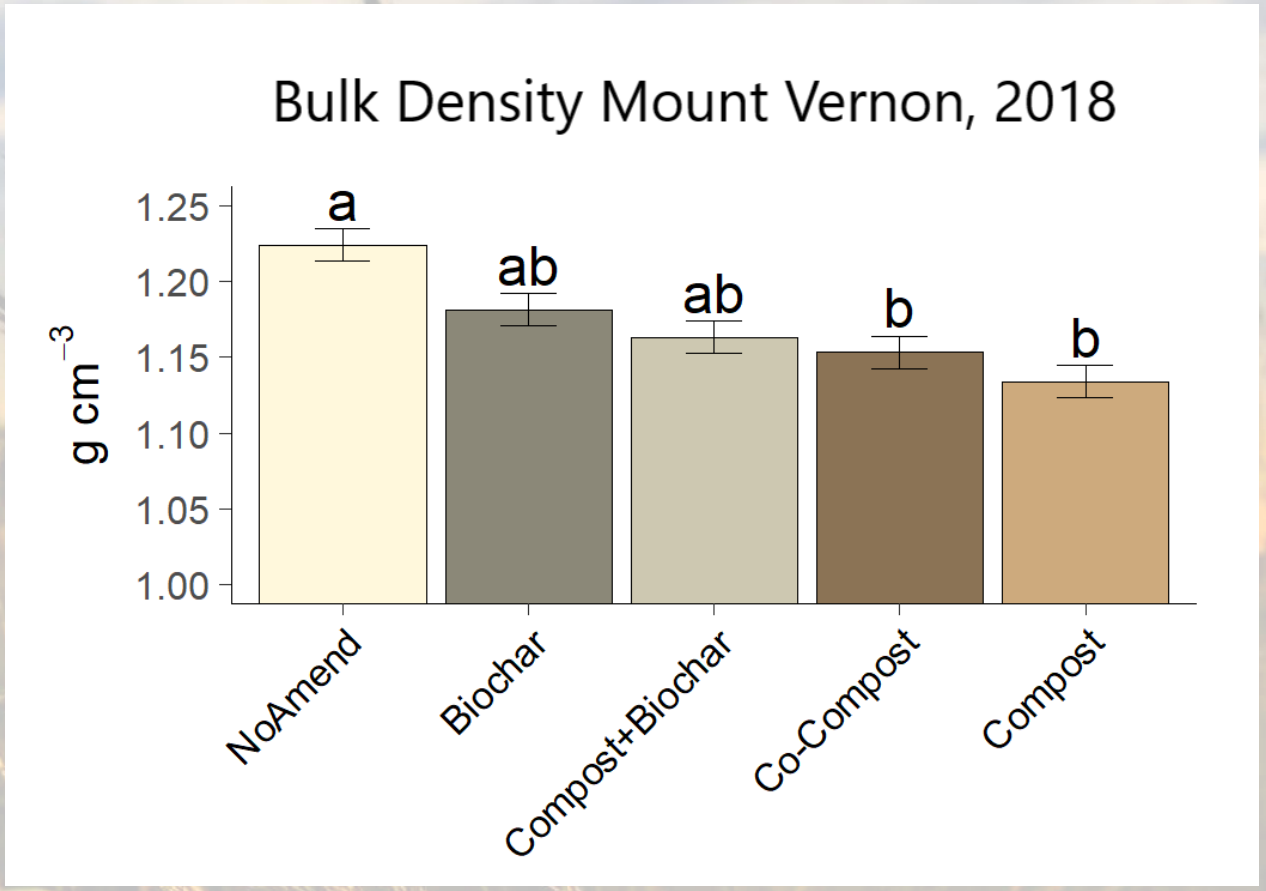


Biochar initial results.

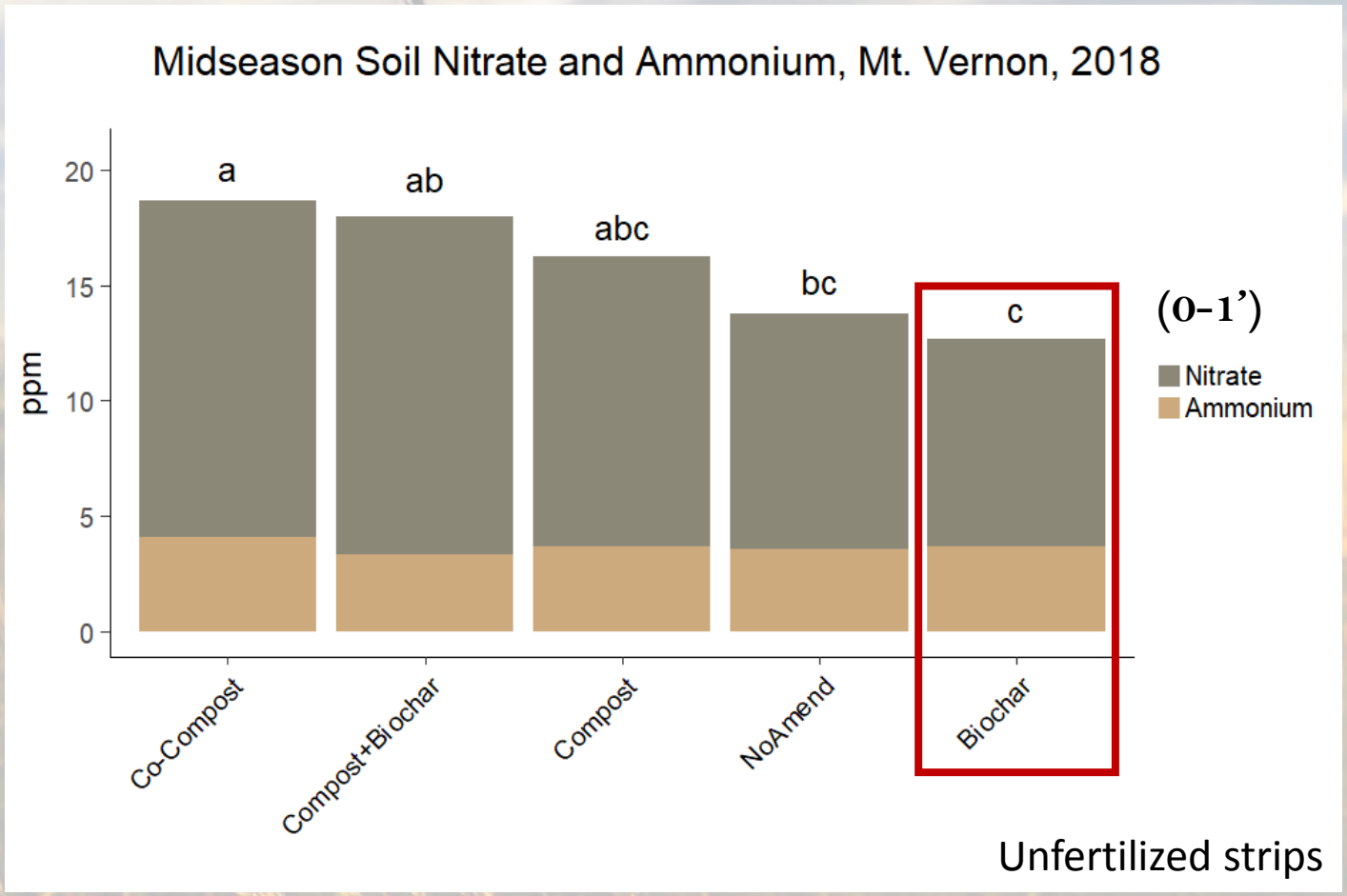


P Values: Fertilizer<0.001; AmendmentXFertilizer=0.01;
Amendment in fertilized plots<0.01;
Amendment in unfertilized plots=0.23

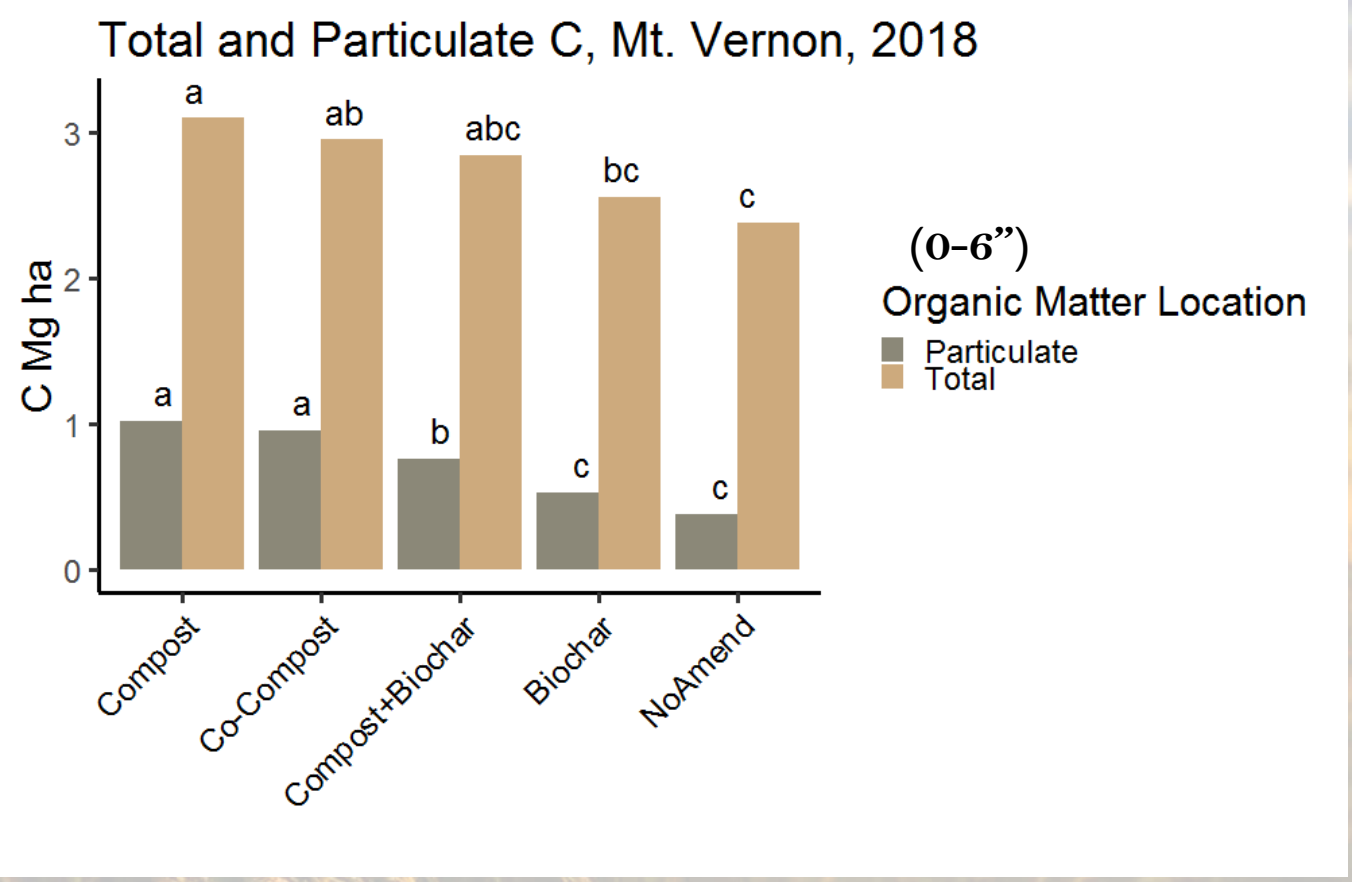
Biochar initial results.



Biochar initial results.



Biochar initial results.



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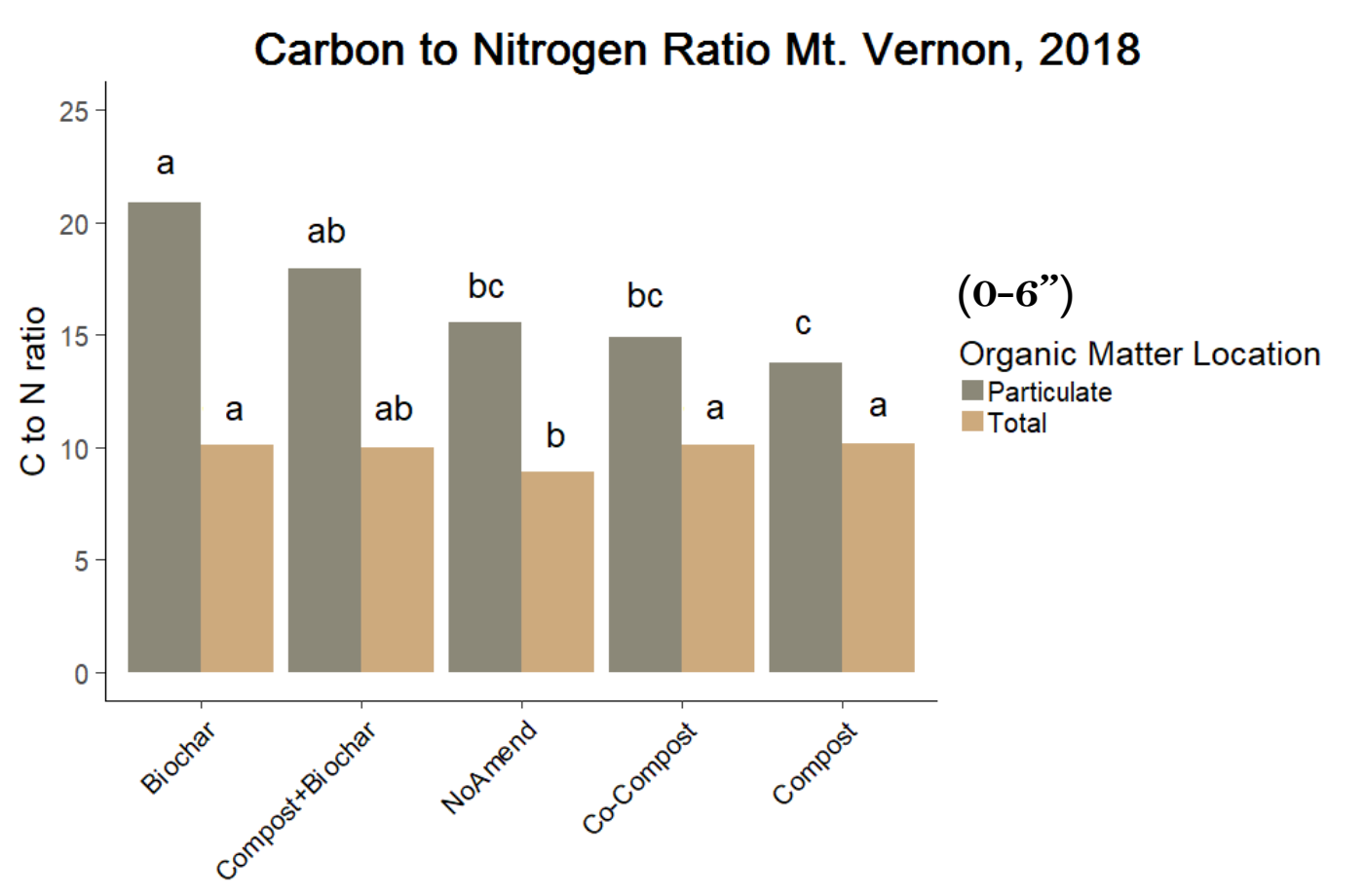

Biochar takeaways.

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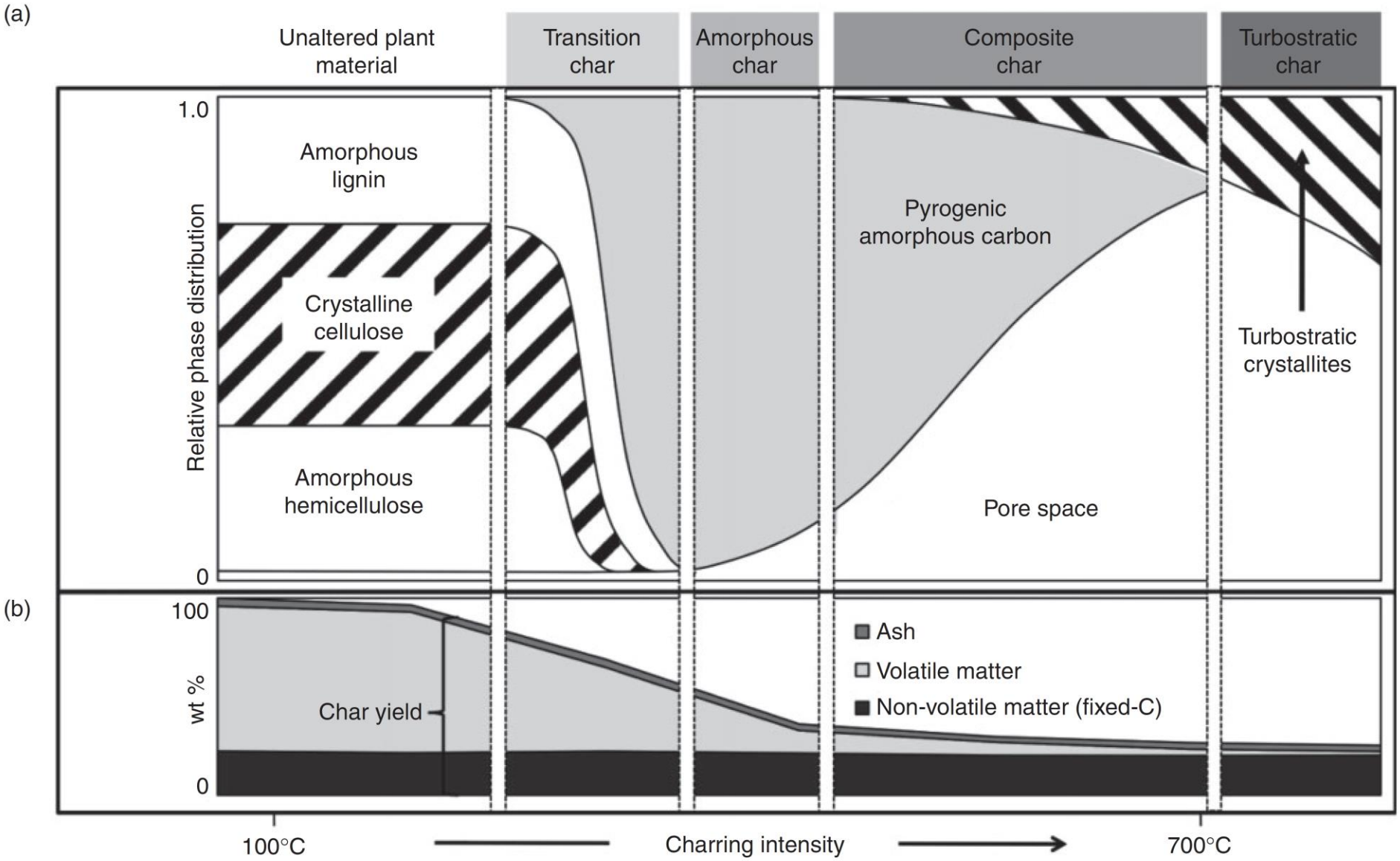
References:

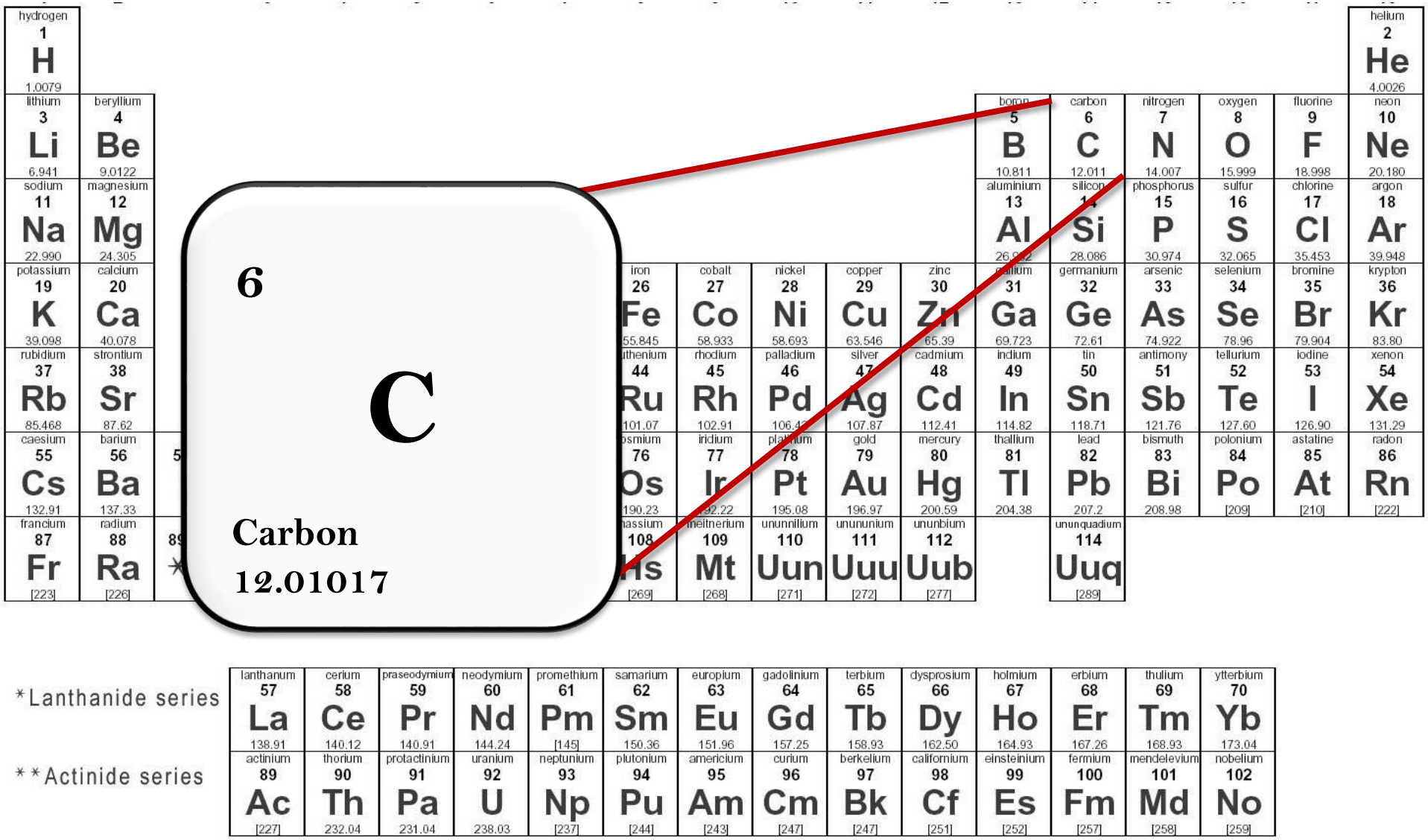
‘Activated Carbon, Biochar and Charcoal: Linkages and Synergies across Pyrogenic Carbon's ABCs’

‘Biochar: A Synthesis of Its Agronomic Impact beyond Carbon Sequestration’

‘State of the scientific knowledge on properties and genesis of Anthropogenic Dark Earths in Central Amazonia (terra preta de Índio)’

‘Benefits and limitations of biochar amendment in agricultural soils: A review’


(a)
Unaltered plant material
Transition char
Amorphous char
Composite char
Turbostratic char
1.0
Relative phase distribution
0
Amorphous lignin
Crystalline cellulose
Amorphous hemicellulose
Pyrogenic amorphous carbon
Pore space
Turbostratic crystallites
(b)
100
wt %
0
Char yield
Ash
Volatile matter
Non-volatile matter (fixed-C)
100°C
Charring intensity
700°C



What is Biochar?

Black Carbon (BC) and soil.

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